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Industrial Wastewater Treatment sequence from Petrochemical companies of pars special Economic energy Zone

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Abstract

Waste water treatment of MOBIN PETROCHEMICAL Company has two separate processing trains. One train for COC Water together With Sanitary Wastewater, another for POC Water alone. Both trains have primary separation, comprising gravity separation followed by dissolved air flotation (DAF units). Because of the higher level of oil contamination in the COC Water, a secondary processing step is required for the COC train. Using biological treatment. The Sanitary water is fed directly to biological treatment rather than to primary separation, since it does not contain oil The most important stage in a waste water treatment plant is activated sludge stage(Aeration Basin), API, DAF, Clarifier, . Many factors affect the performance of waste water treatment. In this work, stage in a waste water treatment plant and effect of COD, MLVSS, pH and other parameter described

Keywords

Activated sludge stage (Aeration Basin), API, DAF, Clarifier, COD, MLVSS, Treatment, Wastewater, COC

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INTRODUCTION

In ASSALUYEH, all wastewaters formed from different petrochemical plants, Olefins, Ammonia/Urea, Methanol, Aromatics and other downstream plants is mixed and entranced into a separate treatment plant, MOBIN PETROCHEMICAL Company situated in ASSALUYEH, by a common header. In this unit, a stream containing different materials and having high level of pollution is treated in different stages. The Figure1 shows different stages of a conventional wastewater treatment plant that has been applied in ASSALUYEH. In the first stage the free oil contained in wastewater is separated in an oil separator by specific gravity difference. The incoming Effluent is substantially contaminated with organic matter, and the level of this contamination may also vary. Accordingly, Balancing Tank is provided for equalization of the wastewater quality by mixing. For eliminating other pollution parameters; COD, suspended solids, color and odor, further treatment stages are applied. It's used Flocculation and Coagulation for removing of suspended solids and oil emulsion, Biological treatment for COD removal and dissolved oil, and sand & activated carbon filters for removing color, odor and also residual suspended solids and COD. Finally the treated effluent eventually disinfected by sodium hypochlorite or chlorine gas. The sequence of waste water treatment plant in Mobin Petrochemical Company describe in Figure 1.

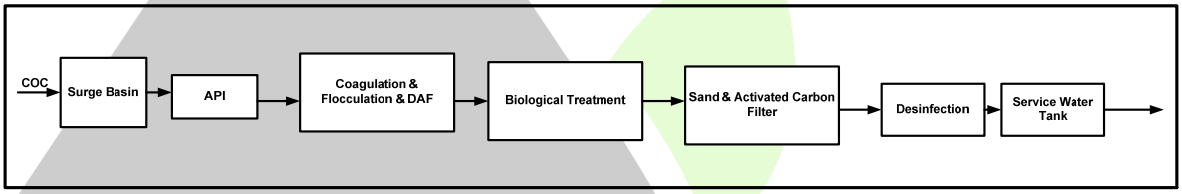

Figure 1:The sequence of waste water treatment plant in Mobin Petrochemical Company

This work has been done in influent waste water coming from different petrochemical plants in actual condition.

Surge basin

Surge basin is provided for collection of excessive flow peaks and off -spec Wastewater.Oil will tend to accumulate on the surface of any wastewater stored in the surge basin.two floating oil skimmers are provided for removal of the surface oil, which is then pumped to the oil separation basin via COC oil pumps.the off-space wastewater collected in the surge basin is reprocessed at a controlled rate in the COC surge basin based on laboratory analisis of the wastewater composition and plant manager"s decision on the appropriate feed rate via POC surge pump.

COC : Continuosly Oil Contaminated effluent water

POC : Potentially Oil Contaminated effluent water

CPI: Corrugated plate interceptor

API *:* The specific gravity or density of oil expressed in terms of a scale devised by the american petroleum institute.

API Oil Separator

An API Oil separator is provided for gravity separation of oil from the COC wastewater.The API-type oil separator is selected for this duty since it is well suited to water containing largr amounts of oil.Two parallel cells are provided for the required capacity.

A CPI Separator is provided for gravity separation of the POC wastewater. A CPI-type separator is selected for this application(rather than an API Oil separator) since the POC waste water is relatively low in oil content, and the CPI separator can achieve a high level of oil removal, which is advantageous for the POC train with only two processing steps.

Balancing

The COC effluent is substantially contaminated with organic matter, and the level of this contamination may also vary. Accordingly, balancing tank is provided for equalization of the wastewater quality by mixing. The Balancing tank is divided in two sections that can be operated either in parallel or individually. The Balancing tank is always operated essentially full for best equalization results, but with variable level to buffer flow fluctuations. In the unlikely event that one section of the balancing tank is completely filled. An emergency overflow threshold is provided, and access water flow over in the other section. An additional balancing of the both section are provided via outset valves and the suction piping system. Each Section of the Balancing tank is equipped with balancing tank mixers to support equalization and prevent the suspended solids to accumulate in the basin. After equalization the wastewater is pumped to the dissolved air flotation unit via .The pumps have variable speed drive to allow for level control in the Balancing Tank.

Dissolved Air Flotation (DAF) Unit

The DAF Unit removes of both oil and also suspended solids. Flocculating additives are injected to break oil emulsions, thus achieving the required oil elimination rate. The unit comprise 2- chamber basin for coagulation followed by flocculation, and then the DAF basin itself. Temperature and pH are monitored in the first chamber coagulation tank and the pH signal is used for pH adjustment by addition of caustic solution(NaOH) and sulphuric(H_2SO_4).Polymer is injected into the first chamber , coagulation tank ,which is equipped with a high-speed mixer .The second chamber , flocculation tank , ensures optimal floc formation ata lower energy input by low-speed flocculation mixer . the mixers speeds are kept constant, while dosage of the flocculating aids is flow proportional controlled .The flocculated wastewater flows by gravity from the flocculation tank via overflow weir into the circular DAF basin.

Aeration Basin

In the biotreatment step, effluent water from the DAF is first aerated together with activated sludge in the presence of the nutrients added in the DAF Effluent PIT. The aerated water then passes to clarifier basins where the biological contaminants degrade and can be removed.

Clarifier

The mixed liquor from Aeration Basin enters well of the Clarifier and is evently distributed within the basin. The mixed liquor flows smoothly from the bottom of the basin.The clarified water is collected in a peripheral channel and is routed from there via dentated overflow weirs to the Clarifier Effluent Pit. The stages of waste water treatment plant in Mobin Petrochemical Company show in Figure 2

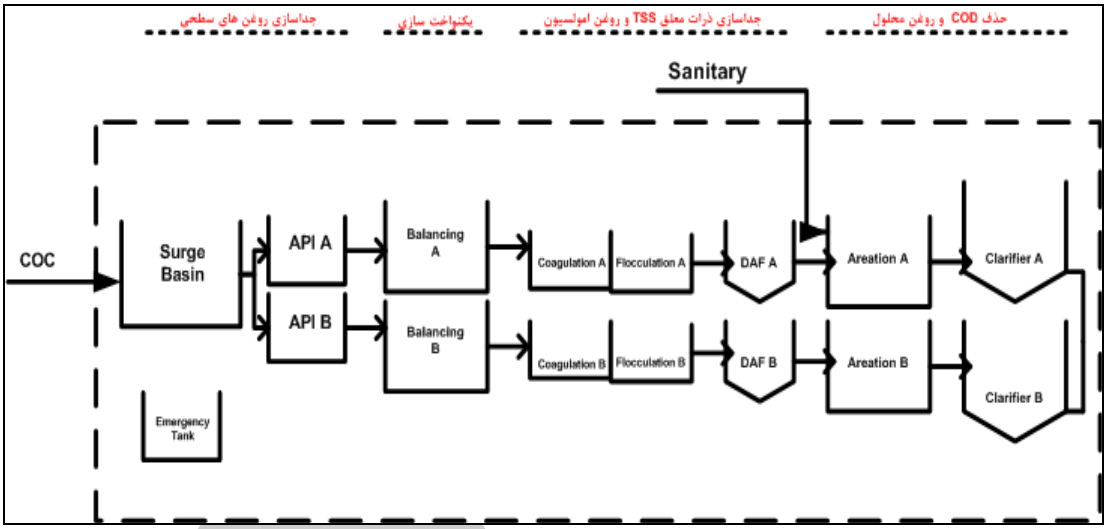

Figure 2: The stages of waste water treatment plant in Mobin Petrochemical Company

MATHERIALS AND METHODS

The treatment efficiency of the stages in term of COD, TSS removal was studied and Properties of Influent waste water outlet stages show in Table1 [1].

Sample / Test	Surge basin	Balancing	DAF	Aeration Basin	Clarifire
COD (Chemical Oxygen Demand) mg/l	851	510	470	38	28
TDS (Total Dissolved Salt) mg/l	916	1825	1750	1450	1322
TSS (Total Suspended Solid) mg/l	17	16	15	8	5

Table1: Properties of Influent waste water outlet stages

The treatment efficiency of the biological stage in term of COD removal was studied for different MLVSS concentrations. It was noted that the process efficiency improved with increase in MLVSS concentration. The removal efficiencies at different MLVSS are given in figure 3 [2].

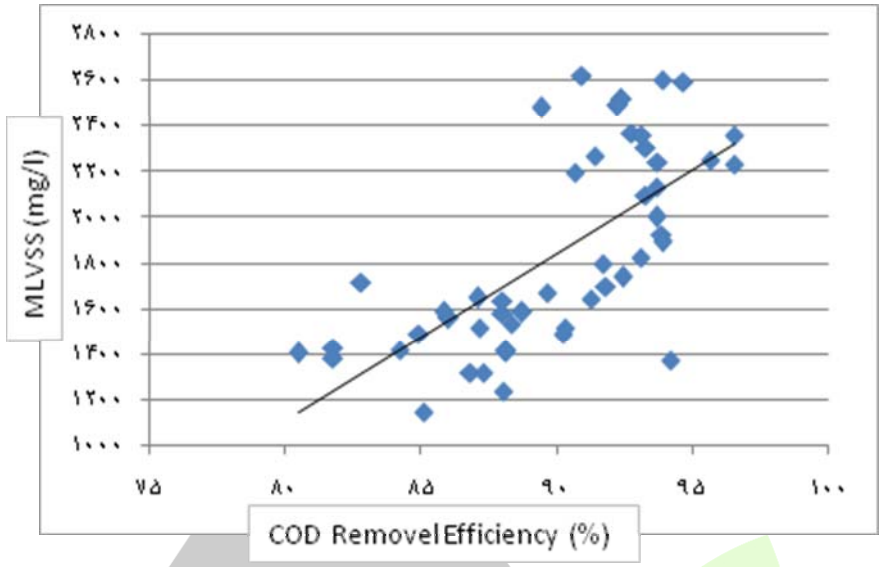

Figure 3: The relation between MLVSS and COD Removal Efficiency.

This also has been found that relation between COD and Conductivity in Clarifier outlet (table2), this relation has been shown in Figure 4.

COD (ppm)	34	48	43	46	45	45	53	48	43	45	50	52	
Cond. (µS/cm)	29.1	27.5	27.3	27	27.1	27.3	27.3	28.5	29.2	29.5	32.8	31.3	

OD (ppm)	65	60	49	50	43	38	38	43	44	48	53	58	
ond. (µS/cm)	24.5	23.9	20.7	19.3	16.6	14.35	13	11.95	11.75	12.3	15.3	17.26	

Table2: relation between COD and Conductivity in Clarifier outlet

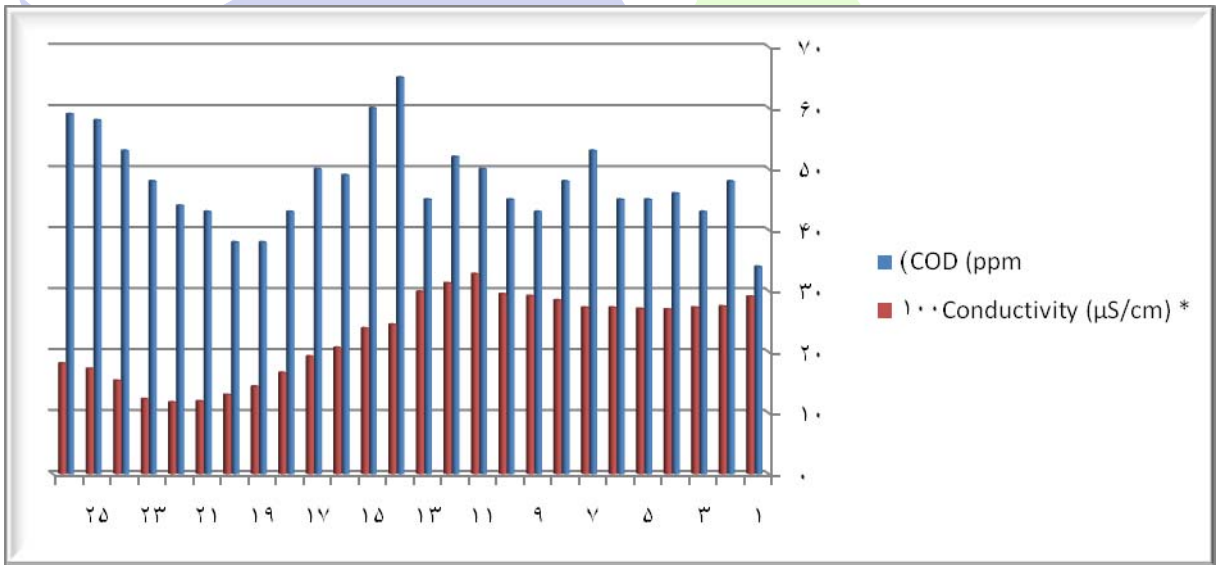

Figure 4: The relation between COD and Conductivity in Clarifier outlet

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RESULT AND DISCUSSION:

Many factors affect the performance of activated sludge process [5]. Various parameters of importance relating to growth of microorganisms on which the operation of biological stage is based include mixed liquor volatile suspended solids (MLVSS) concentration in mg/L, COD influent in mg/L, food to microorganism (F:M) ratio, Nitrogen in mg/L, Phosphor in mg/L , dissolved oxygen (DO) in mg/L in the reactor. Also it has been found that COD in Clarifier are affected by Conductivity Influent (Because many of organic contamination removed in Aeration Basin by activated sludge). By increasing of Conductivity, the COD Effluent is increased (only organic contamination affect on Conductivity).

The present research work was carried out at a laboratory of an actual waste water treatment plant in MOBIN PETROCHEMICAL Company [3]. The objectives were to develop a general guideline for the control process under actual conditions. In this work, the effect of MLVSS and COD Influent on performance of biological stage of this said plant has been considered. These were concluded that by increasing of MLVSS concentration and COD influent, the COD Removal Efficiency is improved. And it was noted that by increasing of MLVSS concentration, the COD effluent is decreased.

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